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several magnitudes lower. For example, the spectrum of *Nova Aquilæ* No. 2 was successfully photographed when the star was of the eleventh visual magnitude.

The dispersion of the one-prism spectrograph is one fifth that of the three-prism Mills spectrograph. The average radial velocity of the brighter stars is about $\pm 20^{\text{km}}$ per second. The equivalent displacement with the one-prism instrument, for the $\text{H}\gamma$ region, is 0.005^{mm} . A radial velocity of 2^{km} would produce a shift of 0.00002 inch (0.0005^{mm}). If the average radial velocity for the fainter stars is about the same as for the brighter, then these small displacements are the quantities to be measured on the plates taken with the one-prism spectrograph. The results obtained are considered highly satisfactory. In the case of *Y Ophiuchi*, with an average exposure of three hours, the double amplitude of the velocity-curve is only 17^{km} . On the Mills spectrograms the same linear displacements would give a curve of $3\frac{1}{2}^{\text{km}}$ double amplitude.

In addition to testing the possibility of extending the usefulness of the one-prism instrument for radial velocity work, it was thought that a contribution might be made toward the discovery of the causes of some of the peculiarities that are observed in short-period variable stars of the δ *Cephei* or η *Aquilæ* type. Some of the more important points to be considered in this connection are: The peculiarities of, and the relation between, the light- and velocity-curves, peculiarities of the spectrum, changes in the character of the spectrum during the period of variability, and the behavior of the individual spectrum-lines.

A Peculiarity of the Spectra.

In the variable stars of the δ *Cephei* type there is a greater richness of photographic radiation relatively to visual radiation at light-maximum than at light-minimum.¹ During the light-period the point of maximum energy on the energy-curve shifts along the spectrum, moving toward the shorter wave-lengths as the star approaches light-maximum, and back again toward the longer wave-lengths as light-minimum is approached. This fact is to a certain extent masked upon the spectrograms by

¹ The observations by WILKENS confirm this point. For five stars he finds the photographic range of brightness to be about one half greater than the visual range. —*Astronomische Nachrichten*, Vol. CLXXII, 305, 1906.

instrumental and atmospheric causes, but in a long series it can readily be verified.

The Individual Spectrum-Lines.

A study was also made of the individual spectrum-lines (blends) to determine whether any of them were shifted regularly during the light-period of the variable. For this purpose thirty-nine lines were selected, and for each line the residuals (O-C)—i. e. the velocity given by the line minus the mean for all the lines measured on that plate—were formed and plotted from the measures of thirty-four spectrograms of *Y Ophiuchi* arranged according to phase in the light-period. The same was done for thirty-five spectrograms of *T Vulpeculæ*. No definite trace of a shift of any of the lines was found which is progressive with the phase of the star in its light-period.

The Variable Star Y Ophiuchi.

Forty-four spectrograms of this variable were obtained. My measures of the first eight spectrograms showed a variable radial velocity, the total range of variation being, however, small.¹ The solution of the orbit by the method of LEHMANN-FILHÉS gave the following elliptic elements:—

$$\begin{aligned}U &= 17.1207 \text{ (light-period),} \\ \mu &= 21^{\circ}.026, \\ T &= 2.6 \text{ days after light-maximum,} \\ \omega &= 209^{\circ}.2, \\ K &= 8.5^{\text{km}} \text{ (single amplitude),} \\ e &= 0.10, \\ V &= -5.0^{\text{km}} \text{ (velocity of system),} \\ a \sin i &= 1,999,000^{\text{km}}.\end{aligned}$$

There is some indication of the presence of a secondary curve, with a period equal to half the light-period and a double amplitude of 2.5^{km} , superimposed upon the elliptic curve given above. This irregularity is such an extremely small quantity for the dispersion employed that we cannot place entire confidence in its reality. It would be equivalent to obtaining a secondary curve of 0.5^{km} double amplitude with the three-prism Mills spectrograph. Attention is called to the fact that the light-curve shows a similar irregularity.

¹ *Publications A. S. P.*, Vol. XVIII, 66, 1906.